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2a. SECURITY CLASSIFICATION AUTHO... .

3. DISTRIBUTION/AVAILABILITY OF REPORT
Approved for public release; distribution unlimited.

2b. DECLASSIFICATION/DOWNGRADING SCHEDULE

4. PERFORMING ORGANIZATION REPORT NUMBER(S)

5. MONITORING ORGANIZATION REPORT NUMBER(S)
AFOSR-TR- 88-0899

6a. NAME OF PERFORMING ORGANIZATION
John Hopkins Univ

6b. OFFICE SYMBOL (If applicable)

7a. NAME OF MONITORING ORGANIZATION
AFOSR/NE

6c. ADDRESS (City, State and ZIP Code)
Materials Science & Eng Dept
102 Maryland Hall
Baltimore, MD 21218

7b. ADDRESS (City, State and ZIP Code)
Bldg 410
Bolling AFB, DC 320332-6448

8a. NAME OF FUNDING/SPONSORING ORGANIZATION
AFOSR

8b. OFFICE SYMBOL (If applicable)
NE

9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
AFOSR-86-0322

8c. ADDRESS (City, State and ZIP Code)
Bldg 410 Bolling AFB, DC 20332

10. SOURCE OF FUNDING NOS.

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT NO.
61102F	2917	A3	

11. TITLE (Include Security Classification) ROLE OF SURFACE & THIN FILM COMPOSITION AND MICROSTRUCTURE & PROPERTIES OF MATERIALS

12. PERSONAL AUTHOR(S)
Dr Druger

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17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR.	

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

SEE ATTACHED DOCUMENTS FOR EQUIPMENT

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20. DISTRIBUTION/AVAILABILITY OF ABSTRACT

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88 8 25 015

SECURITY CLASSIFICATION OF THIS PAGE

G.W.C. Whiting
School of Engineering

The Johns Hopkins University

Materials Science and Engineering

Jerome Kruger
Professor

June 6, 1988

Dr. Alan H. Rosenstein
Air Force Office of Scientific Research
Building 410-NE
Bolling AFB, DC 20332

FINAL REPORT: AFOSR-86-0322 "Role of Surface and Thin Film Composition and Microstructure and Properties of Materials"
Jerome Kruger

1. Attached are the documents indicating the delivery from the Perkin Elmer Corp., Physical Electronic Division, of the research instrumentation supported by this grant. The total charges from Perkin Elmer were as follows:

A. The SAM System		$157,610
B. The ESCA System		$117,500
	TOTAL:	$275,110

The University's matching contribution:

A. Difference between $260,000 from the AFOSR grant and the cost.		$15,110
B. Renovation of the room for the instrumentation.		$40,000
	TOTAL:	$55,110

2. After the completion of the renovation of the controlled climate room required for the surface analytical instrumentation in the summer of 1987, the Scanning Auger Microscope (SAM) and the electron spectroscopy for chemical analysis (ESCA) were installed and the new Surface Analytical Laboratory (SAL) containing this equipment became operational in November 1987. A number of improvements have been made on the installed surface analytical instrumentation at university expense since the opening of the SAL:

   A. The differential pumping system for the ESCA, including a new sublimation pump, was revamped.
   B. A hard disk was installed in the ESCA to accomodate the latest version of the software that controls the ESCA operation.

102 Maryland Hall, Baltimore, MD 21218, (301) 338-8937

C. The PDP1104 that came originally with the SAM was replaced by an IBM AT clone computer enabling the use of software donated by the National Nanofabrication Laboratory at Cornell University.

The ESCA instrumentation has been in service since November 1987. The SAM went on-line in May 1988.

3. The following are some examples of some of the research that has been carried out using SAL:

A. High temperature superconductor studies by Professor C.L. Chien.
B. Corrosion studies of aluminum metal matrix composites and rapidly solidified magnesium by Professor J. Kruger.
C. Studies of organic conductors by Professor D.O. Cowan.
D. Research on resizing of paper by Professor M.S. Barger.
E. Studies of ion implanted BN by Professor J.C. Walker.
F. Passivity studies of alloys in organic solvents by Professor P.J. Moran.

BILLING INSTRUCTIONS
All invoices must be rendered in duplicate to:
Accounts Payable Department
Charles and 34th Streets
Baltimore, Maryland 21218

THE JOHNS HOPKINS UNIVERSITY

PURCHASING DEPARTMENT
BALTIMORE, MARYLAND 21218
PHONE (301) 338-8383

PURCHASE ORDER
No. 7609-54538-4
THIS NUMBER MUST APPEAR ON ALL DOCUMENTS PERTAINING TO THIS ORDER.

THIS ORDER IS SUBJECT TO TERMS, CONDITIONS AND CERTIFICATIONS PRINTED ON REVERSE SIDE HEREOF.

PROF J KRUGER
19
MARYLAND
0055-42-5014-4F
HU ACCT. NO.

23148-0
PERKIN ELMER CORP
PHYSICAL ELECTRONICS DIV
7310 RITCHIE HWY 520
GLEN BURNIE MD 21061

DATE 09/25/86
QUOTATION NO.

FUNDS AVAILABLE FOR PAYMENT OF THE ITEM(S) COVERED BY THIS PURCHASE ORDER EXPIRE ON 07/31/87

THE VENDOR IS HEREBY EXPRESSLY NOTIFIED THAT SHIPMENT OF THE ITEM(S) LISTED BELOW MUST BE MADE IN SUFFICIENT TIME TO BE RECEIVED BY THE PURCHASER PRIOR TO TH EXPIRATION DATE OF FUNDS. THE INVOICE FOR THE ITEM(S) MUST BE DATED AND RECEIVED BY PURCHASER PRIOR TO THE EXPIRATION DATE. UNLESS BOTH REQUIREMENTS ARE MET, THI ORDER WILL BE CONSIDERED CANCELLED WITHOUT FURTHER NOTICE TO THE VENDOR, AND THE PURCHASER SHALL HAVE NO LIABILITY FOR ANY PAYMENT HEREUNDER.

PURCHASE REQUEST NO	F O B	TERMS	REQUIRED DELIVERY
54538	SOURCE	NET 30 DAYS	02/27/87

THE JOHNS HOPKINS UNIV.
CHARLES & 34TH STREETS
BALTIMORE, MD 21218

INCLUDE AS PART OF THE ADDRESS

ATTN PROF J KRUGER
ROOM 19
BLDG MARYLAND

SHIP PREPAID VIA BEST WAY

NO COLLECT SHIPMENTS ACCEPTED

ITEM	QUANTITY	UNIT	MODEL, TYPE, CATALOG OR PART NUMBER	DESCRIPTION	UNIT PRICE	% DISC	TOTAL
1	1	EACH	590	SAM SYSTEM-SEE ATT QUOTE SPEC SHEETS. FOR RE-CONDITIONED, USED INSTRUMENT WITH NEW INSTRUMENT WARRANTY AND WITH ACADEMIC DISCOUNT TO COMPLY WITH SECTION 174 (COPY ATTACHED	150,000.00		150,000.00
2	1	EACH	15-530	SPPR-3594 FRACTURE STAGE	7,500.00		7,500.00
3	1	EACH	88	FRACTURE TRANSFER TIP	110.00		110.00
				**********			
				* INSIDE DELIVERY REQUIRED *			
				* AT THIS LOCATION. *			
				* EQUAL EMPLOYMENT *			
				* OPPORTUNITY REQUIREMENTS *			
				* APPLY. A VALID COMPLIANCE *			
				* CERTIFICATE IS ON FILE. *			
				* QUOTE ATTACHED *			
				**********			

NO CHANGE IN THIS ORDER VALID UNLESS IN WRITING AND SIGNED BY PURCHASING AGENT OR ASSISTANT PURCHASING AGENT.

BUYER P.M. EXT 8760

TOTAL BEFORE CASH DISCOUNT → 157,610.00

ARTICLES COVERED BY THIS ORDER ARE TAX EXEMPT PER SECTION 361 (2) OF MARYLAND RETAIL SALES TAX ACT EXEMPTION CERTIFICATE NO. 3100612 6).

FEDERAL EXCISE TAX EXEMPTION CERTIFICATE 52 73 0126 F, IF APPLICABLE, SHALL APPLY TO THIS PURCHASE.

FOR THE JOHNS HOPKINS UNIVERSITY

BY _____
AUTHORIZED SIGNATURE

1039 REV 7/86

REQUISITIONER

THE JOHNS HOPKINS UNIVERSITY • BALTIMORE, MARYLAND 21218

MATERIALS SCIENCE AND ENGINEERING
MARYLAND HALL

September 24, 1986

Purchasing Department
Whitehead Hall
Homewood Campus

RE: Purchase Request 54538

In reference to the purchase request shown above, we do not want the items listed to go out for open bidding. Our entire faculty has met and reviewed this purchase and recommended it as the optimum combination of price and capabilities to suit the needs of our technology research program. As a result, this equipment and supplier selection has benefited from the cumulative experience and expertise of our entire faculty. We believe the University cannot do better than that. And to second-guess this recommendation would negate the considerable faculty time invested in arriving at the selection.

Sincerely,

Jerome Kruger
Professor and Chairman

JK/h

PERKIN-ELMER

Physical Electronics
Division

7310 Ritchie Hwy.,
Suite 520
Glen Burnie, MD 21061
(301) 761-3053

September 19, 1986

Dr. Jerome Kruger
Johns Hopkins University
Materials Science & Engineering Dept.
Maryland Hall 102
Baltimore, Md. 21218

Dear Dr. Kruger:

Enclosed are configurations and specifications for the PHI Model 590 Scanning Auger and PHI Model 5100 ESCA Systems we discussed on Thursday.

The price for the Model 590 as listed in this configuration is $ 150,000.00. Delivery can be made sometime in February/March of 1987. A fracture stage can be added to the system and I am in the process of determining how much this will cost. You should hear from me within the next week concerning this cost.

The price of the Model 5100 is $ 225,000.00. However, Perkin-Elmer currently has a University Donation program and if you qualify we would donate 50% of this cost to the university. Consequently, the Model 5100 as configured herein would cost you $ 112,500.

Both of these prices are FOB Eden Prairie, MN. It is very important that we receive your order as soon as possible since these instruments are subject to prior sale.

If I can be of any further assistance, please give me a call.

Sincerely,

Guy R. Messenger
Regional Sales Manager

SECTION 174

1. Research and/or experimentation--as defined under Sec. 174 means expenditures incurred in research and development in the experimental or laboratory sense. The term includes generally all such costs incident to the development of an experimental or pilot model, plant process, a product, a formula, an invention or similar property and the improvement of already existing property of the type mentioned.

   An example given in the law states that the contribution of an electron microscope or a computer by the manufacturer will satisfy the use requirement if substantially all the use by the donee college or university consists of training undergraduate or graduate students (either in a laboratory or in a classroom) in how to use the microscope or computer in research, consists of research experiments conducted by such students, e.g., laboratory experiments as part of an undergraduate science course, or consists of a combination of such research and research training.

2. Physical or biological sciences--the physical sciences include physics, chemistry, astronomy, mathematics and engineering, and the biological sciences include biology and medicine.

Model 590 SAM SYSTEM

Configuration:

MODEL	DESCRIPTION
11-500A	Auger System Control
18-070	Scanning Electronics
18-075	Scanning System Control
18-080	Digital Gun Control
04-181	SED
20-075/06	SED Multiplier Supply
25-110	CMA w/Electron Gun
18-030	Power Interlock
20-105	Oven Control
MACS (PDP-1104)	Computer System w/software
20-150	Signal Processor
11-155	Power Supply
15-610	Specimen Stage
04-303	Diffy Ion Gun
11-065	Gun Control
04-220	Gas Admission
2150	Intro System
161	Transfer Assembly
PAR-1105	Interface
TEK604,606,&607	Scopes
40-100	Vacuum Console
18-020	X-Y Recorder
32-010	Lock-In Amplifier
160	Zeta Plotter
605-0505	Digital Gauge Control

August 1982

590AM SYSTEM SPECIFICATIONS

ELECTRON GUN

Source.....	LaB_6 Cathode
Vacuum.....	The entire optical column is operated in a UHV environment
Orientation.....	Coaxial with Auger Energy Analyzer
Lens System.....	dual electrostatic condenser lens Single electrostatic objective lens
Beam Deflection.....	Via 4 pole electrostatic plate assembly
Beam Stigmation.....	Via 8 pole electrostatic plate assembly
Minimum Beam Diameter*....	$\leq$2000 Å @ 10 kV
Accelerating Voltage.....	0 + 10 kV (continuously variable)
Beam Currents (@ 10 kV)...	1×10^{-10} Amps @ .2µm beam diameter* 1×10^{-9} Amps @ .4 µm beam diameter* 5×10^{-8} Amps @ 1.0 µm beam diameter*
Maximum Beam Current.....	$\leq$ 10 µAmps @ 5 kV
Working Magnification.....	Variable from 20X to + 10,000X
Working Distance.....	22.5 mm Analyzer to Target, 8.1 mm End of Electron Gun to Target
Control.....	Operator control of all gun parameters via front panel control knobs. Automatic tracking of deflection, stigmator and lens voltages.

*Beam diameter is determined by using the 20% and 80% signal levels across a 1500 LPI grid.

AUGER ELECTRON SPECTROMETER

Spectrometer Type.....	Full cylindrical mirror analyzer (concentric with electron gun)
Analyzer Capture Angle....	12° - The analyzer is a full CMA and accepts electrons from the full 360° around the analyzer axis. Capture angle is 42° ± 6° from analyzer axis

Energy resolution.....	0.3%, 0.6%, 1.2% externally adjustable. (Actual resolution within ±0.5% of indicated setting).
Energy Range.....	0 to 3200 eV (Computer controlled).
Analysis Area.....	0.6 mm diameter at 0.3% resolution 0.9 mm diameter at 0.6% resolution (signal remains within 10% of maximum value)
Sensitivity Variation.....	$\leq$20% for a +60° to -60° angle between specimen surface normal and electron beam
Detection Mode.....	Pulse counting for lower level signals, with automatic switching to V/F for higher level signals. Switch point from pulse count to V/F is an operator controlled parameter. N(E) vs. E data obtained in pulse count or V/F mode.
Sensitivity.....	$\geq$225,000 cps above background on 920 eV Cu peak Energy Resolution @ 0.6% Beam Energy @ 10 kV * Beam Current @ 1×10^{-8} Amps
Signal to Noise (rms).....	$\geq$325 on Cu 920 peak. (Acquisition time = 1 sec/pt) (pulse count mode) Energy Resolution @ 0.6% Beam Energy @ 10 kV Beam Current @ 1×10^{-8} Amps Signal-to-Noise defined in pulse count mode as S/ B

*Beam current is measured with a +130 V bias applied to the target.

August 1982

SPECIMEN HANDLING SYSTEM

Number of Samples.....	11 plus Faraday Cup.
Degrees of Freedom.....	Three translations plus rotation.
Sample Translation.....	20mm X-Y-Z via micrometer movement.
Position Reproducibility.....	±10μm.
Position Resolution.....	1μm.

SPUTTER ETCHING SYSTEM

Ion Beam Voltage.....	Up to 5 keV variable.
Total Ion beam Current.....	5μAmps.
Ion Beam Current Density.....	>600μAmps/cm^2 @ 50mm working distance (10Å/sec sputter rate on SiO_2 sample.
Ion beam Diameter.....	800μm to 200μm FWHM variable.
Ion Beam Deflection.....	
Electrostatic.....	±0.5mm (X-Y).
Raster.....	Independent X and Y rastering (Maximum 10mm x 10mm) centered on the electrostatic beam position.
Gas Inlet.....	Precise control via precision leak valve (Ar gas used).
Pressure Differential.....	300:1 with 30 liters/sec pumping speed for argon in the main test chamber. 1000:1 with optional turbo molecular pump.

ELECTRON BEAM SCANNING CAPABILITIES

Control.....	Operator control of all beam scanning parameters via front panel switches.
Display.....	TV, Storage CRT, high resolution, CRT, camera, and graphics terminal (w/hard copier).

Display Signals.....	Absorbed current, secondary electron signal and Auger signal.
Scanning Modes.....	TV, photograph, frame, line, point, positive/negative image, y-modulate.

DATA HANDLING SYSTEM

Hardware.....	DEC computer, floppy disk storage, interactive graphics terminal, dry silver copier and PHI computer interface.
Operating Modes.....	Multiple point analysis, survey scans, multiplex depth profile, map, line scans and high resolution scans.
Data Processing Routines.....	Foreground/background, smooth, differentiate, integrate, curve fitting, normalization by E, expansion, quantitative analysis and spectra subtraction.
Computer Controlled..... Instrument Parameters	Multiplier (CMA) voltage setting, sputter gun (on/off), electron beam position and signal detection mode (pulse count or V/F).

VACUUM

Analysis Chamber.....	200 ℓ/sec differential ion pumping. Ti sublimation and LN_2 cryo. Sorption pump roughing. (Pump isolation via poppet valve).
Roughing Manifold.....	dual sorption pumps.
Base Pressure.....	5×10^{-10} Torr. (Dependent on sample outgassing properties).
Vacuum Gauges.....	Thermionic ionization. Gauge (test chamber). Pirani gauge (roughing manifold).
Baking System.....	External ovens for analysis chamber, electron optics and vacuum pumping. (Unit to control bake time is included).

Power Interlock..... total electrical system interlock on vacuum loss (set point adjustable).

ENVIRONMENTAL REQUIREMENTS

Magnetic Fields..... Less than 10 milligauss peak-to-peak.

Relative Humidity..... Less than 50%.

Temperature..... 20°C ± 3°C.

Vibration..... Not to exceed 30μ inches at 1-60 Hz.

POWER REQUIREMENTS

System Baking..... 208/230 V 40A (to be hard wired by customer).

System Operation..... 208-230 V 30A (connector supplied).

OTHER REQUIREMENTS

Liquid Nitrogen..... 10 liters per pump down.

Dry Nitrogen..... 4 PSI maximum (for system backfill only).

ILLING INSTRUCTIONS
All invoices must be rendered in duplicate to:
Accounts Payable Department
Charles and 34th Streets
Baltimore, Maryland 21218

THE JOHNS HOPKINS UNIVERSITY

PURCHASING DEPARTMENT
BALTIMORE, MARYLAND 21218
PHONE (301) 338-8383

PURCHASE ORDER
No. 7609-54539-2
THIS NUMBER MUST APPEAR ON ALL DOCUMENTS PERTAINING TO THIS ORDER.

THIS ORDER IS SUBJECT TO TERMS, CONDITIONS AND CERTIFICATIONS PRINTED ON REVERSE SIDE HEREOF.

PROF J KRUGER
19
MARYLAND
0055-42-5014-4F
U ACCT. NO.

23148-0

PERKIN ELMER CORP
PHYSICAL ELECTRONICS DIV
7310 RITCHIE HWY 520
GLEN BURNIE MD 21061

DATE 09/25/86
QUOTATION NO.

FUNDS AVAILABLE FOR PAYMENT OF THE ITEM(S) COVERED BY THIS PURCHASE ORDER EXPIRE ON 07/31/87

E VENDOR IS HEREBY EXPRESSLY NOTIFIED THAT SHIPMENT OF THE ITEM(S) LISTED BELOW MUST BE MADE IN SUFFICIENT TIME TO BE RECEIVED BY THE PURCHASER PRIOR TO THE PIRATION DATE OF FUNDS. THE INVOICE FOR THE ITEM(S) MUST BE DATED AND RECEIVED BY PURCHASER PRIOR TO THE EXPIRATION DATE UNLESS BOTH REQUIREMENTS ARE MET. THIS DER WILL BE CONSIDERED CANCELLED WITHOUT FURTHER NOTICE TO THE VENDOR, AND THE PURCHASER SHALL HAVE NO LIABILITY FOR ANY PAYMENT HEREUNDER.

CHASE REQUEST NO	F O B	TERMS	REQUIRED DELIVERY
54539	SOURCE	NET 30 DAYS	02/28/87

THE JOHNS HOPKINS UNIV.
CHARLES & 34TH STREETS
BALTIMORE, MD 21218

INCLUDE AS PART OF THE ADDRESS
ATTN PROF J KRUGER
ROOM 19
BLDG MARYLAND

IP PREPAID VIA BEST WAY

NO COLLECT SHIPMENTS ACCEPTED

EM	QUANTITY	UNIT	MODEL, TYPE CATALOG OR PART NUMBER	DESCRIPTION	UNIT PRICE	% DISC	TOTAL
1	1	EACH	5100	ESCA SYSTEM (SPEC ATTACHED RECONDITIONED USED INSTRUMENT WITH NEW INSTRUMENT WARRANTY AND WITH ACADEMIC DISCOUNT TO COMPLY WITH SECTION 174	112,500.00		112,500.00
2	1	LOT		THREE DAYS ON SITE TRAINING.	5,000.00		5,000.00
				**********			
				* INSIDE DELIVERY REQUIRED *			
				* AT THIS LOCATION. *			
				* EQUAL EMPLOYMENT *			
				* OPPORTUNITY REQUIREMENTS *			
				* APPLY. A VALID COMPLIANCE *			
				* CERTIFICATE IS ON FILE. *			
				* QUOTE ATTACHED *			
				**********			

HANGE IN THIS ORDER VALID UNLESS IN TING AND SIGNED BY PURCHASING AGENT SSISTANT PURCHASING AGENT

BUYER P.M. EXT 8760

TOTAL BEFORE CASH DISCOUNT → 117,500.00

ICLES COVERED BY THIS ORDER ARE TAX EXEMPT PER TION 361 (2) OF MARYLAND RETAIL SALES TAX ACT MPTION CERTIFICATE NO 3100612 6I.

ERAL EXCISE TAX EXEMPTION CERTIFICATE 52 73 012a F, IF APPLICABLE, L APPLY TO THIS PURCHASE.

FOR THE JOHNS HOPKINS UNIVERSITY

BY _____
AUTHORIZED SIGNATURE

REV. 7/86

REQUISITIONER

THE JOHNS HOPKINS UNIVERSITY • BALTIMORE, MARYLAND 21218

MATERIALS SCIENCE AND ENGINEERING
MARYLAND HALL

September 24, 1986

Purchasing Department
Whitehead Hall
Homewood Campus

RE: Purchase Request 54539

In reference to the purchase request shown above, we do not want the items listed to go out for open bidding. Our entire faculty has met and reviewed this purchase and recommended it as the optimum combination of price and capabilities to suit the needs of our technology research program. As a result, this equipment and supplier selection has benefited from the cumulative experience and expertise of our entire faculty. We believe the University cannot do better than that. And to second-guess this recommendation would negate the considerable faculty time invested in arriving at the selection.

Sincerely,

Jerome Kruger

Jerome Kruger
Professor and Chairman

JK/h

Han.

Also it's a special deal on used but recently refurbished equip. at half price that we'll lose if we don't act fast

PERKIN-ELMER

Physical Electronics
Division

7310 Ritchie Hwy.,
Suite 520
Glen Burnie, MD 21061
(301) 761-3053

September 19, 1986

Dr. Jerome Kruger
Johns Hopkins University
Materials Science & Engineering Dept.
Maryland Hall 102
Baltimore, Md. 21218

Dear Dr. Kruger:

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Both of these prices are FOB Eden Prairie, MN. It is very important that we receive your order as soon as possible since these instruments are subject to prior sale.

If I can be of any further assistance, please give me a call.

Sincerely,

Guy R. Messenger
Regional Sales Manager

SECTION 174

1. Research and/or experimentation--as defined under Sec. 174 means expenditures incurred in research and development in the experimental or laboratory sense. The term includes generally all such costs incident to the development of an experimental or pilot model, plant process, a product, a formula, an invention or similar property and the improvement of already existing property of the type mentioned.

   An example given in the law states that the contribution of an electron microscope or a computer by the manufacturer will satisfy the use requirement if substantially all the use by the donee college or university consists of training undergraduate or graduate students (either in a laboratory or in a classroom) in how to use the microscope or computer in research, consists of research experiments conducted by such students, e.g., laboratory experiments as part of an undergraduate science course, or consists of a combination of such research and research training.

2. Physical or biological sciences--the physical sciences include physics, chemistry, astronomy, mathematics and engineering, and the biological sciences include biology and medicine.

Model 5100 ESCA System

Configuration:

Model	Description
5000BA01	Base System
5000CP04	Color Printer
5000PC02	Ion Pump and Control
5000IP03	50 l/sec turbo/auto
5000SH01	Single Specimen
5000AL01	4 Element Lens
5000XR03	Al/Mg Anode
5000IE01	Diffy Ion Gun

Specifications enclosed

PERKIN-ELMER

6/10/85

Performance, Engineering, and Environmental Specifications

++ ++ ++ ++

PHI Model 5100

ESCA System

ESCA performance on Ag $3d_{5/2}$

Resolution FWHM (eV)	CPS
0.80	40,000
0.86	110,000
1.00	220,000
1.40	500,000
2.15	1,000,000

Specified performance is attained with a 4 mm x 10 mm input slit and a single Mg anode operating at 20 mA and 15 kV (300 W). Performance will meet or exceed the curve defined by the above values.

ELECTRON ENERGY ANALYZER

Type	180° spherical capacitor analyzer (SCA).
Mean Diameter	279.4 mm.
Input Slit Dimensions	4 mm x 10 mm.
Input Lens	4 element.
Detector	Channeltron electron multiplier with amplifier/discriminator.

ANALYZER ELECTRONICS

Energy Scan	
Range	0-4800 eV for ESCA; 0-3200 eV for optional ISS.
Resolution	25 meV minimum stepsize.
Pass Energy	
Range	0-200 eV.
Resolution	50 meV.
Multiplier	
Input Bias	0 to ± 200 V.
Multiplier Voltage	0 to + 3000 V.
Polarity	Single; dual polarity available for optional ISS.

X-RAY SOURCE

Energy Range	Variable; 4 keV to 15 keV.
Anode	Dual anode design.
Anode Material	Side 1-Mg, Side 2-Al; Mg, Cu, Si, Zr, Au, Ag, or Ti optional on Side 2.
Power	750 W total (15 kV, 50 mA); maximum 400 W during single anode operation.
Anode Selection	Computer controlled or manual switch select.
Source Cooling	Recirculating heat exchanger with deionizer cools anode and housing; positioned up to 7.6 m (25 ft) from system.
Coolant	Deionized water.
Safety Interlocks	High voltage and coolant flow rate.

COMPUTER SYSTEM

Hardware	P-E Series 7000 Professional Computer; includes color graphics, dual 12.7 cm (5 in) floppy disks, 10 Mbyte Winchester hard disk, 32 switchable function keys, and 8 bezel mounted soft keys.
Data Acquisition Modes	Survey, multiplex, and depth profile.
Data Processing Modes	Foreground/background, smooth, differentiate, integrate, normalization by E, expansion, quantification, subtraction, addition, deconvolution, and curve fit.
Hard Copy Output	Color printer or optional video copier.

SAMPLE HANDLING

Specimen Stage

Sample Capacity	Single sample; 8 sample optional.
Sample Translation	Vertical translation of ± 0.5 cm with resolution of ± 10 µm.
Sample Tilt (optional)	± 60° from horizontal with ± 1° resolution.
Sample Cooling (optional)	-100° C using LN_2.
Stage Automation (optional)	Computer control of sample sequencing and/or sample tilt.
Sample Mounting	Flat, recessed, or Faraday cup mounts.
Electrical Feedthroughs	4 BNC connectors.

Specimen Introduction

Type	Single sample, manual insertion.
Valve Control	Manual; automatic optional.
Pumping	Dual sorption pumps; 50 ℓ/sec air-cooled turbomolecular pump optional.
Introduction Time	Less than 10 min from air to analysis with non-outgassing sample.
Specimen Transfer (optional)	Vacuum transfer device; can be equipped with appendage ion pump.

ANALYSIS CHAMBER

Type	Stainless steel; copper gaskets.

Rough Pumping

Type	Dual sorption pumps; 50 P/sec air-cooled turbomolecular pump optional.
Range	Ambient to 10^{-3} Pa (10^{-5} Torr) with turbopump.
Gauging	Thermocouple gauge in introduction chamber.

UHV Pumping

Type	120 ℓ/sec differential ion pump, with optional Ti sublimator and cryopanel or 4000 ℓ/sec cryopump.
Range	10^{-3} to 10^{-8} Pa (10^{-5} to 10^{-10} Torr).
Gauging	Digital pressure readout of ion pump pressure; nude thermionic ionization gauge in analysis chamber optional.
Guaranteed Base Pressure	6.5×10^{-7} Pa (5×10^{-9} Torr) standard; 6.7×10^{-8} Pa (5×10^{-10} Torr) following bake-out and using optional Ti sublimator.
Vacuum Interlock	Electrical power to analysis electronics disabled when preset vacuum level is reached (set point is adjustable).
System Bakeout	Analysis chamber and installed optics bakeable with specimen stage micrometers removed.
Ovens	Heating elements integral to instrument console and ion pump; fabric shroud for analysis chamber.
Temperature	Greater than 100°C but less than 200°C.
Control	Automatic bakeout timer.

ION ETCHING SOURCE (OPTIONAL)

Type	Electron impact with dual electrostatic lenses.
Beam Voltage	200 V to 4 kV, variable; computer controlled.
Beam Current	Greater than 5 µA at 4 kV.
Beam Rastering	Independent X and Y rastering; approximately 10 mm x 14 mm area.
Pressure in Analysis Chamber	Less than 6.7×10^{-5} Pa (5×10^{-7} Torr); less than 1.3×10^{-5} Pa (1×10^{-7} Torr) with optional differential pumping.
Gases	Ar; He^3, He^4, or Ne^{20} optional.

Specifications indicate minimum guaranteed performance. Systems will meet or exceed stated specifications. Specifications are subject to change without notice.

Effective 6/10/85

ENVIRONMENTAL REQUIREMENTS

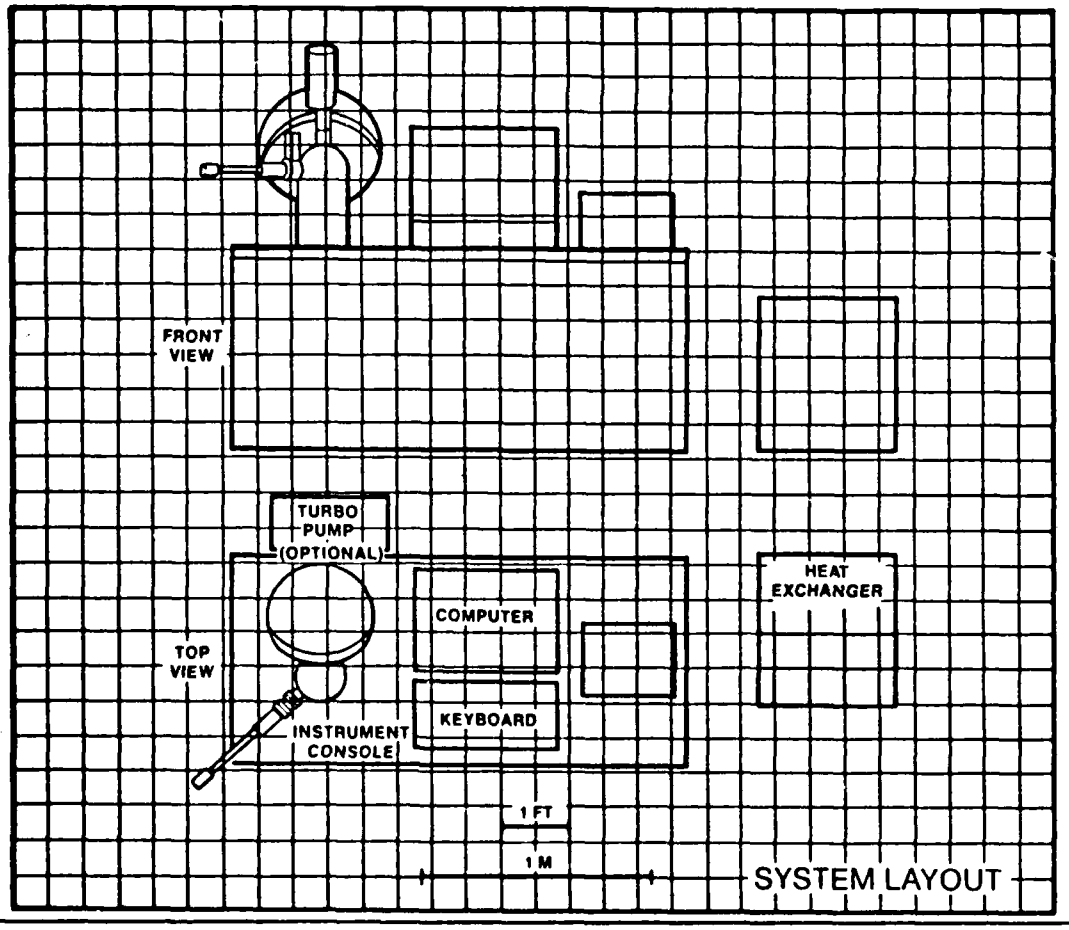
Magnetic Fields	Less than 2 μT (20 mG) peak-to-peak.
Relative Humidity	Less than 70%.
Temperature	20°C ± 5°C.
Heat Dissipation	2344 W (8,000 BTU) under typical operating conditions.

UTILITY REQUIREMENTS

Electrical	200-240 VAC, 50-60 Hz, 40 A single phase (to be hard wired by customer).
Liquid Nitrogen	
Test Chamber Pumpdown	10 ℓ per test chamber pumpdown from atmosphere (not required with turbopump).
Sample Introduction	10 ℓ per day for sample introduction typical (not required with turbopump).
Dry Nitrogen	0.279 kg/cm^2 (4 PSI) maximum.
Compressed Air	5.6 to 7.0 kg/cm^2 at 0.17 m^3/hr (80 to 100 PSI at 0.1 CFM) pressure regulated (required only with auto valve control option).

SHIPPING AND INSTALLATION

Shipping Weight	Approximately 1360 kg (3000 lb).
Shipping Volume	Approximately 8.4 m^3 (300 ft^3).
Laboratory Entrance	92 cm (36 in) minimum (access required for system to clear).



SYSTEM LAYOUT

PERKIN-ELMER

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